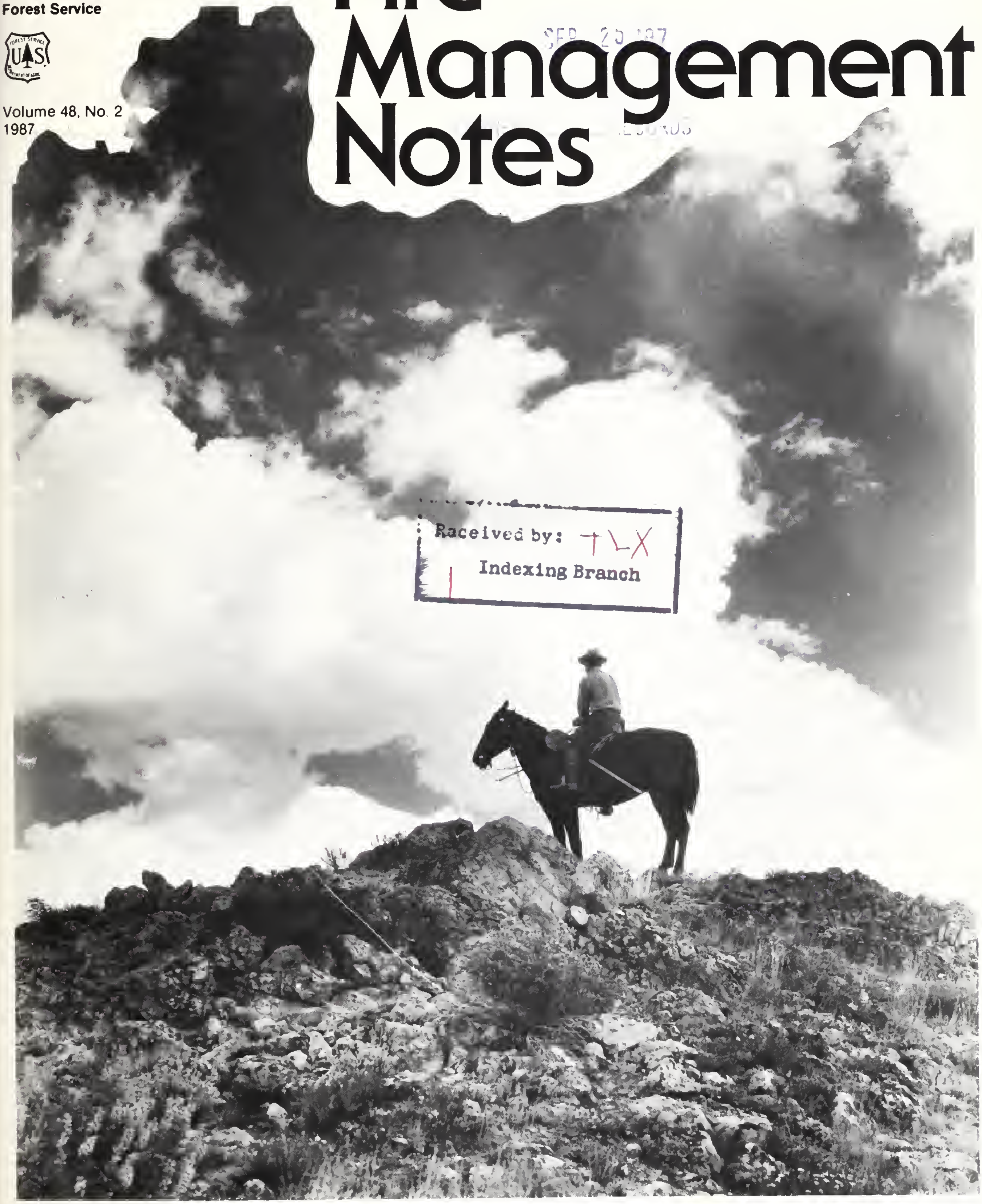
United States
Department of
Agriculture

Forest Service

Volume 48, No. 2
1987

Fire Management Notes



Fire Management Notes

An international quarterly periodical devoted to forest fire management.

United States Department of Agriculture

Forest Service

Volume 48, No. 2
1987

Contents

3 Initial Attack Food Pack
Bill E. Williams and Tom French

5 The Evolution of Wildland Fire Management and Policy
John W. Chambers

9 An Examination of Fire Season Severity Rating
Don J. Latham

12 Going To Bat Against Wildfire
Gladys D. Daines

14 The Redmond Roadrunners
John Holcomb and Bonnee Turner

16 User Attitudes Toward Fire Policy in Wilderness Areas
Stephen E. Stine

18 Wildland Fire Hazards: Safety and Survival Guidelines for Recreationists and Homeowners
Kathleen M. Davis and Robert W. Mutch

21 A Versatile New Mini-Pump/Sprinkler Kit
Tom French and Bill E. Williams

23 Calibrating the Initial Attack Analysis Process
Alexander P. Dimitrakopoulos

25 A Look at Fire Prevention in Mexico
James C. Sorenson

Cover: Smokechaser watching for lightning on the Sawtooth National Forest in Idaho, 1929. See story beginning on p. 5.

Fire Management Notes is published by the Forest Service of the United States Department of Agriculture, Washington, D.C. The Secretary of Agriculture has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department.

Subscriptions may be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Send suggestions and articles to Chief, Forest Service (Attn: Fire Management Notes), P.O. Box 96090, U.S. Department of Agriculture, Washington, DC 20090-6090.

Richard E. Lyng, Secretary
U.S. Department of Agriculture

F. Dale Robertson, Chief
Forest Service

L. A. Amicarella, Director
Fire and Aviation Management

Francis R. Russ,
General Manager

Initial Attack Food Pack

Bill E. Williams and Thomas French

Respectively, supervisory forestry technician and warehouseman, USDA Forest Service, Payette National Forest, McCall, ID

The use of initial attack food packs on the Payette National Forest has evolved considerably from the days when the smokejumpers made up their own food packs, individually, from bins of mostly canned foods. Freeze-dried foods have been added and the food pack standardized for use by all initial attack units on the forest, replacing C-rations. In 1982, complaints about palatability and variety led to an improved food pack, designed by a forest committee of users. The improved pack has been very successful. The food pack is now used by the 80-person smokejumper unit, two forest helitack crews, and all district initial attack crews and engine crews. The forest warehouse made up and issued 2,143 food bags during the 1986 fire season (fig. 1). The average since 1982 has been about 1,800 annually.

Description

The food pack, which weighs 10 pounds, will feed a firefighter for 2 days or six meals. It consists of a mix of canned and freeze-dried foods, combined with high-energy snacks, and includes a 1/2-gallon honey can for heating water. Everything is packed in a stout, reusable canvas bag with eyelets and a drawstring. Packing is accomplished by placing bins on tables, filling the bins with components and having each packer fill a basket with proper components, then pack and seal the bag. Packing time is about 2 minutes per bag. Snack and accessory packets are made up in advance (fig. 2).

Variety is maintained by having several types of entrees, fruits, vegetables, and beverages. Generally, no two food bags are exactly the same. Palatability has been tested by questioning field users and eliminating items that are not well received. New items are evaluated carefully and then tried on a trial basis prior to being accepted for general use. By buying the components in case lots or larger quantities, the cost has been reduced to approximately $20 per bag, or about $3.33 per meal.

Figure 1 — *The initial attack food pack used on the Payette National Forest contains a variety of canned and freeze-dried foods.*

Components

Each food bag has a snack packet consisting of four small boxes of raisins, three packages of dried fruit, a high-energy snack bar, and four granola bars. The snack packet is assembled in a plastic bag and placed at the top of the food bag where it is easy to get out. This quick-access snack packet is for times when the fire situation does not permit stopping for a meal but energy is needed.

An accessory packet has utensils, napkins, condiments, beverage mixes, and can opener and is also assembled in a plastic bag for easy access. The meal component of the food bag includes selections of canned foods, two fruit, two juice, two vegetables, four meat, fish, or soup, and two selections of prepared foods such as pork and beans. The freeze-dried portion of the food pack consists of two dinners, a trail lunch, granola, oatmeal, gorp or lurp, and beef jerky.

Advantages

Most components for the food pack can be purchased locally and as needed, which eliminates the shelf life problems of meals-ready-to-eat (MRE). By using color-coded plastic seals, the food bags can be rotated

Figure 2 — *Easily accessible snack packet provides sources of quick energy.*

so that the oldest stock is always used first. Palatability and variety are much better than with the old rations or MRE's, and the menu can be easily adapted to local food preferences. The meals have been evaluated and found to be nutritionally well balanced.

The cost is considerably less per meal than MREs ($3.33 per meal for food pack compared with $4.41 per meal for MREs). Field acceptance and comments on the food pack have been very positive. Recently the Boise National Forest became interested in the food pack, based on reports from field people who had used the packs on the Payette. The Boise has since started using the same type of food pack.

For units with a light initial attack workload, the extra effort of ordering components and packing food bags may not be worthwhile. But for units with a good deal of activity, this kind of food pack is definitely an attractive alternative to MREs or totally freeze-dried meal packs. Packing lists, sources of supply, and tips on packing are available from the Payette National Forest on request. ■

The Evolution of Wildland Fire Management and Policy

John W. Chambers

Assistant director, Fire and Aviation Management, USDA Forest Service, Washington, DC

The objectives of this paper are to provide background information on historical fire management in the United States and to describe the evolution of public wildland fire management policy, particularly in the Forest Service. Knowledge of the evolution of fire management policy and the forces which shape it provide a better understanding of the role of fire management in public land and resource management today and of what may influence its role in the future.

The Formative Years

Public concern about the threat of wildfires to persons and property began with the "cut and get out" timber harvest practices on private lands in the Lake States during the late 1800's and early 1900's. These practices resulted in tremendous accumulations of slash that were subsequently ignited by land clearing operations as people moved westward, settling the land. Catastrophic wildfires were common.

In 1885, a wildland fire control program was initiated in the Adirondacks Reserve in New York. Wildfire suppression was initiated in the West in Yellowstone National Park in 1886. A House of Representatives report stated that the most important duty of the Park Superintendent and his assistants was to protect the forests from fire and axe. Fire suppression responsibility in the Park was assigned to the Army, the beginning of organized wildland fire suppression in the Federal sector. The Army soon demonstrated that wildfire could be effectively controlled.

The 1905 Forest Reserve Use Book cited three principal duties of forest officers:

- To protect the Reserves against fire.
- To assist the people in their use of the Reserves.
- To see that the Reserves are properly utilized.

Our roots in European forestry provided American foresters with a vision of fire-proofed forests—there could be no professional forestry without the control of fire. At the same time, fire was being used as a management tool in the South and in California where it was commonly referred to as "light burning" by the locals or "Paiute forestry" by its opponents (2). "Light burning" or "controlled burning" in general became a political controversy.

In 1910 catastrophic fires burned over 5 million acres in the northern Rocky Mountains. In the same year, William James published "On the Moral Equivalent of War," an indication of what forest firefighting was to become in the Forest Service—a paramilitary fire control cause that shaped Forest Service policy for decades. The debate over the merits of "light burning" largely disappeared. Chief Forester Henry Graves wrote that fire prevention was 90 percent of forestry. The Forest Service became entrenched in a single policy line of fire prevention and control that was to last for more than 50 years.

The debate over "light burning" versus protection rekindled in the early 1920's, even within the Forest Service. Forest Service Chief William Greely, when asked to summarize the main problems with the forest in 1923, replied, "stop the fires" (fig. 1). The "light burning" controversy was overcome by "professional forestry" advocates by 1924 as the Forest Service struggled for political survival and forestry for its scientific credibility. The 10-acre control objective and the economic philosophy of minimizing cost plus loss became Forest Service fire suppression policy in 1926.

The 10 a.m. Policy

The Tillamook burn occurred in 1933, charring 300,000 acres of essentially virgin timberland in the Northwest. This catastrophic occurrence and the newfound availability of manpower in the CCC program led to the establishment of the 10 a.m. policy and hour control objectives in 1935. Organized emergency fire crews, the management of organized fire suppression forces, and the development of formal line construction methods emerged during the Civilian Conservation Corps period. The moral equivalent of war had been declared on wildfires. The 10 a.m. policy was considered to be consistent with fire control objectives established in 1926 in that the sum of suppression cost plus loss was expected to be less under an all-out suppression policy, eliminating uncertainty and lack of aggressiveness (fig. 2).

The Age of Mechanization

World War II led to the age of mechanization in fire control. The war effort resulted in the development and eventual availability of military equipment suitable for fire

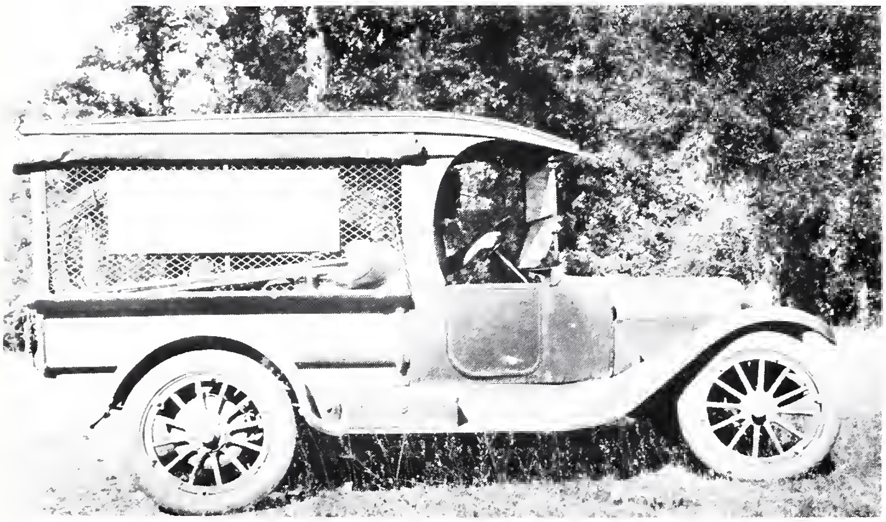


Figure 1 — *Fire truck ready for use on the Mendocino National Forest in California, August 1923.*

control. Fire control equipment development centers were established to take advantage of opportunities for mechanization.

Equipment development efforts with aerial retardant delivery led to the first operational use of air tankers in 1956. Operational use of helicopters soon followed. Effective fire suppression organization, labor, equipment, and technology were largely developed and operational by the early 1960's.

The Age of Specialization

Other than a modification in 1971, providing for limited lighting-caused fires in wilderness, the Forest Service 10 a.m. policy continued unchanged. In 1971, the 10-acre suppression policy was incorporated as a presuppression planning objective. This was followed by a major fire planning effort in 1972. Forest Service presuppression expenditures skyrocketed in the mid-1970's as a result of "fire departments" developed in response to 1972 fire planning and greatly increased funding. Numbers of fires and acres burned also increased in spite of expanded presuppression programs in many of the wildland fire control agencies.

As wildland fire protection programs became larger and more sophisticated, Federal and State agencies found it necessary to formally coordinate programs, standards, and procedures. The National Wildfire Coordinating Group (NWCG) was chartered in 1976 for this purpose.

The National Interagency Fire Qualification System (NIFQS) was

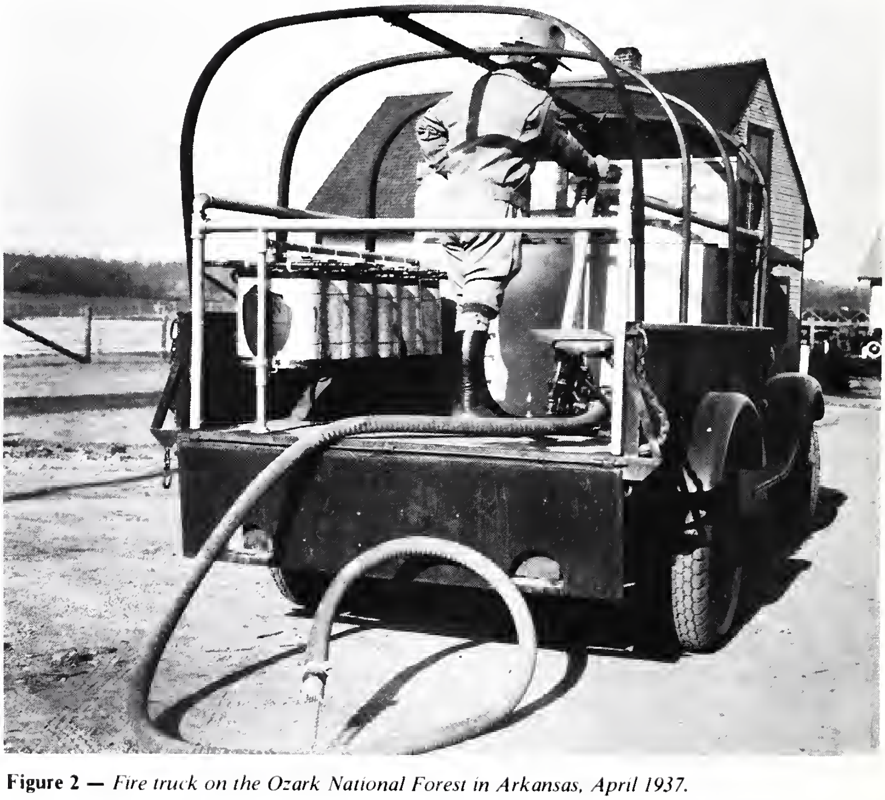


Figure 2 — *Fire truck on the Ozark National Forest in Arkansas, April 1937.*

developed under the sponsorship of NWCG for the purpose of assuring a nationwide source of professional wildland firefighting personnel qualified for the positions for which they had been certified.

Fire Management Comes of Age

The Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA) and the National Forest Management Act of 1976 (NFMA) required that both the use of prescribed fire and the control of wildfire be an integral part of the Forest Service land management planning process. Further, fire management was to be responsive to resource management objectives in a cost-effective manner.

In 1977 the Chief directed that a study of presuppression effectiveness by conducted. The study concluded that fire management objectives must be directly related to resource values and to the costs of protecting them, and that protection should be commensurate with values and risks. The product should be an accountable, efficient, and cost-effective program.

Forest Service fire policy was revised in 1978 to provide for the integration of both protection from fire and the planned use of fire in National Forest land and resource management planning (1). The objective of wildfire suppression was changed from one of prompt control of all wildfires by 10 a.m. to one of minimizing fire suppression costs and damage consistent with land and resource management direction. An escaped fire situation analysis (EFSA) was to be prepared by the land manager whenever a wildfire escaped initial attack to determine the most appropriate suppression response (3). Appropriate fire suppression strategies included containment, confinement, and control. Prescribed fire to protect, maintain, and enhance National Forest resources was reaffirmed as an approved management practice (fig. 3).

In 1983, Forest Service fire management policy regarding appropriate suppression action as well as escaped fire suppression strategy was based upon an objective of minimizing suppression costs and resource damage.

Forest Service wilderness fire management policy was revised in 1985 clarifying the objectives of wilderness fire management and the use of prescribed fire within wilderness. Forest Service ignited prescribed fires were authorized when necessary to meet the objectives of (1) allowing lightning fires to play their natural role and (2) reducing the risk of wildfire to life and property within wilderness, and to life, property, and resources outside of wilderness to an acceptable level.

The Age of Sophistication

The increasing complexity of wildland fire suppression in the urban/wildland interface in southern California, and a disastrous fire season in 1970, led to implementation of the FIRESCOPE program. The Incident Command System (ICS) evolved from this program in response to the need to more effectively integrate and localize the suppression resources of Federal, State, and local fire protection agencies.

Recognizing that the presence of two separate fire suppression management organizations was undesirable in the long run, the National Wildfire Coordinating Group sponsored a study in 1980 to evaluate both the Large Fire

Figure 3 — *The use of prescribed burning on the national forests was reaffirmed in 1978.*

Organization (LFO) and the Incident Command System. NWCG adopted the National Interagency Incident Management System (NIIMS) in 1981 as a result of this study. NIIMS built on the strengths of the LFO, ICS, and other FIRESCOPE technologies to provide a common, integrated emergency management system for the interagency management of emergency incidents of all types. By 1982, all Federal agencies and many States had adopted NIIMS for implementation. The Incident Command System element of NIIMS was fully implemented by all Federal agencies and in many States by 1985.

In 1986, the increasing fire protection concerns in the wildland/urban interface were recognized as being national in scope. A national initiative involving Federal, State, and local fire protection agencies and related organizations was begun with the objective of reducing the loss of life, property, and resources from fires occurring in the wildland/urban interface.

Other Agencies

The evolution of fire management policy in the Forest Service reflects the general evolution of wildland fire management policy in all Federal wildland management agencies. Cooperative agreements with the Forest Service for fire protection had virtually assured similar fire management direction for many years.

The Bureau of Indian Affairs pioneered the use of prescribed fire among the Federal agencies. Recognition of the natural role of fire and of prescribed fire as a management tool evolved in the National Park Service, Bureau of Land Management, and the U.S. Fish and Wildlife Service much as it had in the Forest Service—sometimes ahead, sometimes behind.

Summary

It was as keeper of the flame that man first became steward of the land. Effective fire protection became the foundation for natural resource investments and intensive management. Organized fire suppression was founded upon the premise that control of the occasional large catastrophic fire was most effectively done by "hitting them hard and keeping them small."

Through years of development and improvement in techniques, equipment, and capability, fire suppression personnel in Federal and State wildland fire protection agencies became very proficient. Expertise, capability, and funding led to specialization and the emergence of a fire department concept in the 1970's. Fire suppression emphasis in the 1980's is upon cost efficiency and more effective interagency utilization of suppression resources. The concept of fire suppression being everyone's business is also returning due to budgetary constraints and the desire for more cost-efficient fire management programs. In recent years, land management agencies have acknowledged, and have begun to provide for, the natural role of fire in wildland ecosystems. Cost-efficient fire management programs consistent with resource management objectives have emerged. Skills in predicting fire effects, evaluating fire management alternatives, developing and executing prescribed burning plans, and smoke management are now essential in addition to the traditional prevention and suppression skills.

The path followed by wildland fire managers has been a noble one. At every step, dedicated personnel have done what they felt they had to do, and did it proudly and well. ■

Literature Cited

1. Nelson, Thomas C. Fire management policy in the national forests—a new era. Journal of Forestry. 77(11); 1979.
2. Pyne, Stephen J. Fire in America. Princeton, NJ: Princeton University Press; 1982. 654 p.
3. U.S. Department of Agriculture, Forest Service. Forest Service Manual. 5132.1 Washington, DC: U.S. Department of Agriculture, Forest Service; 1984.

An Examination of Fire Season Severity Rating

Don J. Latham

Meteorologist/physicist, Fire Behavior Project, USDA Forest Service, Intermountain Research Station, Intermountain Fire Sciences Laboratory, Missoula, MT

The problem with "fire season severity" is that we all seem to know what we mean by the phrase, but no one agrees on a precise, quantifiable meaning. Season severity seems to fall in the same class of descriptors as "a good year for wheat," which all farmers worth their salt can immediately interpret. Such descriptors are useful and summarize a large amount of topically grouped information, but are quantitatively weak and difficult to use for purposes requiring precision, such as economic analysis and planning. They enable conversation in loose qualitative fashion (which most of us seem to prefer) rather than in tables of statistics (which most of us do not prefer).

This loose or qualitative approach can be examined by simply listening to conversation on the topic. Season severity seems to be a combination of:

- a perception of personal or group suppression effort,
- a measure of the areal extent of fires,
- the duration of the active period,
- a perception of the energy release ("hot" etc.),
- something to do with the fuel moisture, and
- an expression of the rate of occurrence of fires (a "fire bust").

Conversations involving season severity (or "badness" of the season) invoke, as do other "whittle and argue" concepts, the memory of past seasons as analogs or as comparison yardsticks (this season is a lot like. . .) for the current season or the one under discussion. These memories seem to involve, for some, only the "severe" or "bad" years, not the "benign" ones. That is, the season under discussion is only related to specific years if it is itself considered "severe" or "bad." If the season being discussed is seen as "easy" or "benign," it is not related to a specific season or seasons, but is simply lumped with all other nonsevere years. There seems to be a special category, a season that should have been bad but for some reason was not. Note that a fire season is referred to as "bad" but not "good," "easy" but not "hard or difficult," and "benign" but not "malignant." Even more confusing is that a "bad" season can be called "good" in conversation if you're getting a lot of overtime!

As fire-oriented people, we might do well to simply acknowledge that fire season severity is one of these "whittle and argue" concepts to be employed and enjoyed in conversation, and we would do so except for some very desirable reasons to formulate an overall season descriptor:

- To facilitate formal or institutional comparison of seasons,
- To aid in performance assessment of firefighting organizations,
- To aid in justification of expenditures, and
- To improve prediction ability, for preparedness, prepositioning, and the insistent human need to know what's coming.

To be truly useful, each of these uses requires a carefully defined, quantitative expression of season severity so that all parties to the conversation are on common ground. There have been many attempts to provide such measures. Most of these are apparently driven by the need for a fire organization to rate its effectiveness and to justify its spending of funds. This is hardly new. Gisborne (*8*), for example, mentions the need to compare the season from "unit to unit":

> A special need of comparable fire-danger ratings arises annually in the office of the Chief of the Forest Service. Each year the [Chief] Forester is called upon to report to the Congress and to the public (1) the status of fire danger during the past season, and (2) how this danger was met, in terms of area burned and money spent. As the basis for such reports, each of the regions must submit fire-danger measurements or opinions of the character of the fire season. These are compared with the fire records in order to rate fire-control efficiency according to fire danger experience. . . .

This approach continues through the years to the present, and in many fire organizations. A few examples:

> When are the year-to-year variations in costs and accomplishments of a fire control organization due to variations in fire weather? When are the variations due to prevention and control action? To a combination of both? An index to the severity of fire weather by seasons can help answer these questions if the index separates the effects of weather on fires from the effects of prevention and control activities. (*3*)

> By comparing actual fire occurrence with that reasonably expected, a fire control officer can assess the effectiveness of prevention and suppression efforts. (*4*)

> Field personnel in all forest fire protection agencies need some simple but reasonably accurate method for evaluating severity of the fire season as it progresses and of comparing the severity of the current season with that of preceding fire seasons. (*2*)

> The Seasonal Severity Index is useful as an administrative tool to estimate the

potential fire control job in an area during a fire season. . . .(5)

Severe fire years are determined mainly by the incidence of days of "Extreme" fire danger. . . .Estimates of. . .effectiveness of fire suppression activities. . .are impossible unless the severity of individual forest fire seasons is known. (10)

A Fire Season Severity Index is useful because it indicates the relative severity within and between fire seasons attributable solely to weather. (9)

In any effort to review a fire program on an annual basis, one of the first questions which the analyst or fire manager asks is, "What level of fire activity occurred during a given year?" At present, there is no satisfactory means of providing a quantitative expression to answer this question. (7)

Each of the quoted papers contains a proposed severity index, each index is different from the others, and none seems to be in widespread use in the fire community. The above examples, by no means exhaustive, illustrate some of the errors inherent in fire season severity indexes or analyses:

- Confusion of measurement of response with respect to prediction rather than actual occurrence.
- Assumption of connection between weather and fires.
- Estimation of the effects of intervention in the natural fire process.

Almost without exception, proposed severity assessment schemes call, either explicitly or tacitly, for measuring responses to fire occurrence with respect to fire danger, or fire weather, predictions. This approach, typified by, but not limited to, Cramer's (4) statement, is a serious error. Performance should only be judged by referring the

Rating fire season severity depends heavily on subjective criteria.

response to what actually happened, not to what might have happened.

A prediction system, if perfect, would tell us exactly what is going to occur. But prediction systems are not perfect. We can thus measure the effectiveness of the prediction system by measuring some kind of difference between what actually happened and what was predicted. But we cannot arrive at a meaningful measure of firefighting system effectiveness by measuring its response to a prediction, especially one that has

large errors. Effectiveness must be measured by response to reality, however far from the prediction that may be.

Assessment of system performance against hypothetical situations as a system test is a common procedure, of course. This kind of testing is used on military, disaster aid, and urban fire control systems. The test situations are carefully set up and controlled to elicit measurable responses. The tests might even use historical situations. If a measure of the quality of system response to wildland fires is desired, then tests should be set up and performed according to the procedures for such things. Even proper tests measure effectiveness against the test, not against reality.

The second error is in use of the weather-fire connection. This connection is at present not well understood. What is known, or surmised, is formalized for fire use in the National Fire-Danger Rating System (NFDRS) (*6*) and in the BEHAVE fire behavior system (*1*).

The NFDRS produces a fire danger rating for large areas and is based on some proven and some assumed connections between weather, ignition sources, fuels, fuel state, and fire occurrence. This system was designed as a planning and warning aid and not as a specific prediction tool. Assessing fire system response against the output of the NFDRS is thus twice in error: not only by measuring against a prediction, but also against a prediction designed for a totally different use.

BEHAVE is designed to aid fire organizations in ongoing wildfire and prescribed fire situations. It connects weather, fuels, and fuel moisture in order to predict such specific physical quantities as rate-of-spread and heat intensity. It is designed for real-time and short-range prediction, not to assess system performance.

Many of the indexes proposed above use past fire data in some form. These data are biased by the prevention and suppression efforts in effect at the time. Schemes for the evaluation of effectiveness based on size statistics or the occurrence of fires are in error because they reflect at best only an effect due to change in policy or technique. Because of the high variance of fire statistics, many seasons of data are necessary to reflect changes in these system properties. Once again, the temptation is to measure the effect of changes against predicted values rather than against reality.

Is all lost? Is the fire community to be left with only arm-waving and whittling? Of course not. We have a real need for quantitative descriptions. The definition of fire season severity rests, however, on subjective criteria. Severity ratings must be based on institutional and people needs. It is up to the fire community to thrash out a definition, or perhaps several, depending on use, and get on with our whittling. **The author would very much like to hear from all those who are interested in providing input for a definition of fire severity. Send your ideas to the Intermountain Fire Sciences Laboratory, P.O. Box 8089, Missoula, MT 59807.** ■

Literature Cited

1. Andrews, Patricia L. BEHAVE: Fire behavior prediction and fuel modeling system—BURN subsystem. Part 1. Gen. Tech. Rep. INT-194. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station; 1986. 130 p.
2. Barney, Richard J. Fuel moisture—a guide for evaluating severity of fire seasons. Research Note INT-13. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station; 1964. 8 p.
3. Countryman, Clive M.; Intorf, P.H. A fire season severity index for California National Forests. Misc. Pap. 14. Berkeley, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Forest and Range Experiment Station; 1953. 7 p.
4. Cramer, Owen P. Relation of number and size of fires to fire-season weather indexes in western Washington and western Oregon. Res. Note 175. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station; 1959. 11 p.
5. Deeming, John E.; Lancaster, J.W. National Fire-Danger Rating System. Fire Control Notes. 32(2): 4-8; 1971.
6. Deeming, John E.; Burgan, Robert E.; Cohen, Jack D. The National Fire-Danger Rating System—1978. Gen. Tech. Rep. INT-39. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station; 1977. 63 p.
7. Gale, R. Evaluation of fire management activities on the National Forests. Policy Analysis Staff Report. Washington, DC: U.S. Department of Agriculture, Forest Service; 1977. 127 p.
8. Gisborne, H.T. Measuring fire weather and forest inflammability. Circ. 398. Washington, DC: U.S. Department of Agriculture; 1936. 59 p.
9. Kiil, A. D.; Quintilio, D. Occurrence and behavior of forest fires related to fire danger rating in Alberta, 1957-1963. Information Report #A-X-25. Calgary, AB: Forest Research Laboratory; 1969. 20 p.
10. Vines, R.G. A survey of forest fire danger in Victoria. Australian Forestry Research. 4(2): 39-44; 1971.

Going To Bat Against Wildfire

Gladys D. Daines

Smokey Bear Program Manager, USDA Forest Service, Fire and Aviation Management, Washington, DC

"Smokey and the Pros" began in 1984 as a cooperative effort between the California Department of Forestry, the USDA Forest Service, and five California-based Major League Baseball teams. This wildfire prevention program was designed for use during Smokey Bear's 40th Birthday celebration.

Letters were sent to the Los Angeles Dodgers, California Angels, San Francisco Giants, Oakland A's, and the San Diego Padres asking them if they were interested in participating in a wildfire prevention program and all five teams responded. They were interested in discussing the possibilities for the coming year. Meetings were held with each of the teams and plans were finalized.

The baseball teams volunteered their players and support in producing baseball card sets and posters for distribution at Smokey Bear Day games. Public service announcements were produced for use on television.

The theme for Smokey and the Pros was "teaming up with Smokey" or "going to bat against wildfire" and the message was directed at young people with the message appealing to a much wider audience.

Smokey and the Pros generated a lot of enthusiasm. The Los Angeles Dodgers presented Smokey with a birthday cake in a home plate ceremony. They presented wildfire prevention messages on their scoreboard.

Smokey Bear throwing the first ball at the San Francisco Giants game.

Smokey threw out the first pitch at the Padres game in Jack Murphy Stadium. Padres player card sets were distributed to the crowd, and a fire prevention message was shown on the public service announcement screen.

The Oakland A's celebrated with a Family Day. They had a baseball game featuring the players' children against their famous dads before the Big League game. Smokey joined in the fun by serving as umpire for this event. Then Smokey threw the first pitch for the main game.

"Fire Prevention Is Teamwork" was the theme of the California Angels game with Smokey throwing the first pitch. Fire prevention messages were displayed on the scoreboard, and California Angels player card sets were handed out to the fans.

A poster featuring Smokey Bear and the slogan "After 40 years. . .still the same message: Remember only YOU can prevent forest fires" was handed out to San Francisco Giants fans. Posters were also distributed by the Giants to schools and libraries following the game.

The 1984 season was so successful in California that Smokey and the Pros was continued in 1985 and 1986. Early in 1986 the Commissioner for Major League Baseball was contacted regarding possible participation in a National Smokey and the Pros event. The Major League teams decided to participate by celebrating the Old-Timers Series

with Smokey Bear. In cooperation with the Office of the Commissioner, Smokey Bear completed a 15-event tour in 14 cities. Smokey appeared during the Old-Timers Series representing the Forest Service, the National Association of State Foresters, and the Commissioner of Major League Baseball. Local television and radio stations identified the events and announced that Smokey would be in attendance at the games. At each game, Smokey accepted an ash tree, symbolizing Major League Baseball's Family Tree. Average attendance at each of these events was 23,400 for a total exposure of 351,000 fans.

All 26 Major League teams, including the two Canadian teams, will participate in National Smokey and the Pros days during August 1987. These special activities and the associated materials that will be distributed will bring Smokey and the fire prevention message to an estimated 131,000,000 people. ■

The Redmond Roadrunners

John Holcomb and Bonnee Turner

Respectively, foreman, Redmond Interagency Hotshot Crew, and regional fire training specialist, USDA Forest Service, Redmond Air Center, Redmond, OR

The 1986 fire season marked the 26th year of the Redmond Interagency Hotshot Crew or "Redmond Roadrunners" as they are informally known. The crew of this 26th anniversary had another successful summer with 20 suppression assignments, several fuel treatment assignments, and hundreds of hours of fire and fuels classroom and field training.

The crew has come a long way since August 1960 when it was established as the first interregional fire suppression "hotshot" crew in Forest Service Region 6. Gone are the days when they lived in apartments above the Pastime Tavern in downtown Redmond, OR, and when a wooden statue, now standing in front of the drugstore across the street, would accompany them on flights out of region.

For the first 20 years, the Redmond Hotshot Crew functioned with seasonal employees as crew members. In 1980, the detailer concept was assigned to the regional training specialist at Redmond for overall program direction. In 1981, the crew was converted into a detailer program based at Redmond Regional Training Center with staffing to include a project leader who plans, directs, and implements the training portion and a crew foreman who directs suppression activities. The overall objective is to take future managers of land management organizations, be they in or out of the fire organization, and give them an opportunity to gain valuable experience in understanding the overall picture of managing Federal land.

Candidates apply through a training announcement in January of each year and, if selected, are detailed for a 3-month period beginning the last of May. The Region furnishes each detailer with meals, lodging, salary, training materials, equipment, and supplies. The USDI Bureau of Land Management and Bureau of Indian Affairs have both participated as well as Forest Service Region 5. In addition, Forest Service Regions 8 and 9 are each offered one slot annually.

The idea of the detailer program has been in existence for some time with employees being assigned at one time or another to most of the hotshot crews in Region 6. The Redding Hotshot Crew in Region 5 was the first to use the detail concept to fill out the entire crew. Their successful program was initiated in 1967 and consists of suppression training and fire experience. Region 6 sent detailers to the Redding Crew throughout the 1970's; however, the number of interested applicants far exceeded the available openings.

In 1977, a fire fatality of an assistant fire management officer in Region 6 spurred many in fire management to support the establishment of a detail crew within the Region. In addition, it was felt that many Region 6 personnel were rising into positions of responsibility without having a breadth of fire experience due to the irregular occurrence of large fire activity and diversity within the Region. Personnel detailed to a crew with a curriculum of both fire management and suppression at an early stage in their careers would be able to gain experience and training that they might never obtain at their home unit.

One of the primary missions of the Redmond Interagency Hotshot Crew is to provide a fully trained and equipped 20-person category I suppression crew. Crew members have top priority dispatch for a target minimum of 40 days actual fire suppression assignments. They must mobilize quickly and be capable of accomplishing any fire-related task normally assigned to hotshot crews. During the past 6 years, they have seen action on 77 fires in Alaska, Washington, Oregon, California, Idaho, Nevada, Montana, and Wyoming. They have assisted various agencies including the Bureau of Land Management, Bureau of Indian Affairs, National Park Service, Fish and Wildlife Service, Oregon State Department of Forestry, and several central Oregon rural fire departments.

While on assignment, the duties of squad boss and crew boss are filled by the detailers on a rotating basis under the supervision of the crew foreman. Depending on crew members previous experience, they may be given control of the crew or may work as crew boss trainee. As their suppression experience and leadership skills are developed, they assume more of the crew boss qualification responsibilities.

The crew is also utilized on a wide variety of fuels management projects, which benefits both the host agency or unit as well as the crew members by accomplishing on-the-ground training. Assignments include Westside Cascade broadcast burning, Eastside Cascade broadcast

The 1964 Redmond Interagency Hotshot Crew.

burning and underburn, and broadcast burn for range and wildlife improvement.

When not on assignment, crew members complete intensive formal classroom training. The curriculum includes all "S" (skill) and "I" (Incident Command System) courses that are prerequisites to Crew Boss qualificaiton. In addition, S–390 Intermediate Fire Behavior; I–330 Task Force/Strike Team Leader; First Attack Incident Commander—Multi-Resources; Crew Management, and miscellaneous other fire courses are offered. The fuels curriculum includes 40 hours of Elements of Fuels Management, other specialized fuels training, and a variety of field trips to see on the ground fuels reduction application.

At the end of each summer's detail, the participants return home as fully qualified crew bosses and with a strong background in both fire and fuels management. They have been involved with both Eastside and Westside Cascade fuels reduction application and have developed a broad fuels and fire management career foundation. In addition, they have had the opportunity to participate on many suppression assignments, develop leadership skills, broaden their horizons in multiagency organizations and operations, participate in career planning, and learn more about themselves and their involvement in a truly team effort.

The program is writing its own success story. With most graduates feeling they gain 5 to 6 years of training and experience in the one detail season, the results are quite evident. Many have been promoted both within and outside the fire management community. On one fire in northeastern Oregon in the summer of 1986, 10 graduates were serving in crew boss or strike team leader positions, coming from as far away as Alaska and Michigan.

The Redmond Roadrunners look back with pride at their first 26 years of service. They also look forward to the new challenges of the future. With a little luck and a lot of hard work, it will indeed be, "On To 50." ■

2H5

User Attitudes Toward Fire Policy in Wilderness Areas

Stephen E. Stine

Fire specialist, USDA Forest Service, Northeastern Area, Broomall, PA

The last 15 years have brought about substantial changes in the wildfire policies adopted by the USDA Forest Service. The change in fire policy from one of total suppression for all fires to one of cost-effective strategies has resulted in many questions concerning the effect of fire on the resources and on national forest users. Wilderness fire is one aspect of the forest's resources that can pose complex questions for both fire and recreation management planners. Wilderness areas with high recreation values and substantial fire occurrence may require more stringent fire management objectives.

To determine the policy preferences and fire knowledge of wilderness users, a survey was conducted in September and October 1986 of three national forest wilderness areas (River of No Return, Selway-Bitterroot, and Bob Marshall) in Idaho and Montana. The survey consisted of 33 questions with a sample size of 400. Respondents' names and addresses were taken from wilderness registration cards and wilderness permit records. Response rate was 70 percent. Fire and Recreation Staff personnel were interviewed to determine which survey questions would best provide the needed information. Some of the questions to be answered by the study included: How do wilderness users want fires fought? Are further education efforts needed to gain increased user acceptance of the changes in wilderness fire policy? How does fire damage impact the perceived value of the recreation experience?

River of No Return Wilderness Area in Idaho. A majority of wilderness users surveyed felt that low-intensity fires would not change the value of the recreation experience.

Fire Policy

To determine how wilderness users want fires fought, questions were included concerning planned and unplanned ignitions. For example, responses to questions concerning prescribed fire policy indicated user support is strongest when prescribed fires are ignited by natural causes rather than agency intervention. The weaker support for agency ignition, as opposed to natural ignition, may indicate additional education efforts are needed in familiarizing users with the conditions under which agency-initiated burns may occur.

The present Forest Service policy of putting out human-caused fires was strongly supported by user groups as was the present policy of allowing fire started by natural causes and within prescription to burn. However, based on a review of past wilderness user studies, it appears there has been an erosion in support for controlling all human-caused fires.

Other questions tested users' willingness to allow fires (from all causes) to burn in seldom used areas of the wilderness. Wilderness users gave strong approval to allowing fires in seldom used areas. They were not as strong in agreeing on what to do with fires spreading beyond these areas. Responses to these questions indicate the potential for user acceptance of more agency flexibility in fire management decisions regarding seldom used areas of wilderness.

If more flexible fire policies are adopted, additional research will be needed in determining decision criteria. For example, wilderness users considered the quality of the natural resources to be an important decision criterion in determining whether a fire should be allowed to

burn, yet support for using the quantity of recreation activity as a criterion was not strongly supported. Criteria should consider the characteristics of both the recreation user groups and the resources themselves.

Users' Knowledge of Fire

Based on questions testing fire knowledge, wilderness users within the Northern Rocky Mountain Region appear to have a good understanding of some of the characteristics of wilderness fire. For wilderness users in the Northern Rocky Mountain Region, a new extensive fire education effort does not appear necessary. If new fire education efforts are undertaken, they should be toward the specifics of wilderness fire management (e.g., the effect of fire on different types of tree species).

Fire and Recreation Value

Survey respondents were asked to state the dollar amount they would be willing to pay per day to participate in their wilderness recreation activity. They were then asked to revise the amount on the basis of viewing drawings of the effects of low- and high-intensity fires. The overwhelming majority of users felt the effect of a low-intensity fire would not change the value they previously stated. The surprising information is two-thirds of the users also felt the effect of a high-intensity fire would not change their original value.

Conclusions

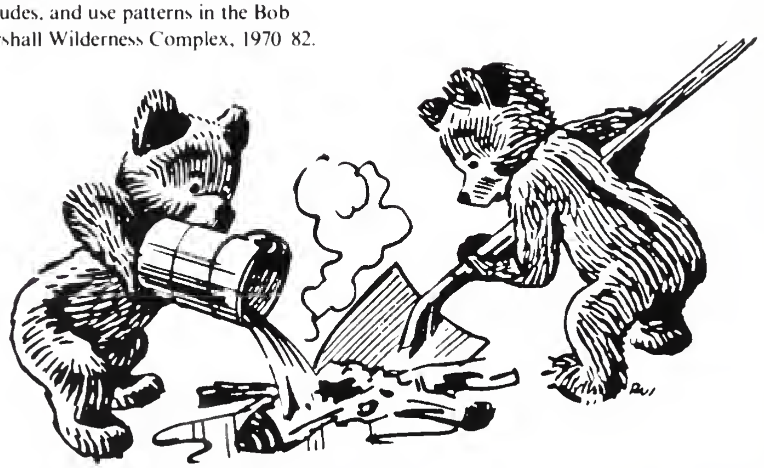
Users accept and support the natural fire processes within wilderness areas. However, the reasons for user support of fire policies are not always the same as an agency's reasons for a certain policy. User perceptions can conflict with agencies' policies and agenda and from the intent of the Wilderness Act. In addition, support for wilderness fire policy was surveyed only for the Northern Rocky Mountain Region. Results may vary in other sections of the country.

The level of technical fire knowledge, as demonstrated by wilderness users, makes them well suited to understanding complex fire concepts. Any new wilderness fire education efforts should be designed to take advantage of higher knowledge levels.

The effect of fire on the value of the recreation experience does not appear to be significant, especially for low-intensity fires. Higher intensity fires do result in decreased recreation value but not by as much as expected. ■

Literature Cited

1. Lucas, R.C. Visitor characteristics, attitudes, and use patterns in the Bob Marshall Wilderness Complex, 1970 82. Research Paper INT 345. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station; 1985.
2. Marlow, L.D. An interpretation of wilderness users' preferences in wilderness area management. Cooperative agreement contract 12 11 196 007. University of Washington and U.S. Department of Agriculture, Forest Service; 1967.
3. McCool, S.F.; Stankey, G.H. Visitor attitudes toward wilderness fire management policy, 1971 84. Research Paper INT 357. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station; 1986.
4. Nelson, T.C. Fire management policy in the national forest a new era. Journal of Forestry. 77(11): 723 25. 1979.
5. Stankey, G.H. Wilderness fire policy: an investigation of visitor knowledge and beliefs. Research Paper INT 180. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station; 1976. 17 p.
6. Zwolinski, M.J.; Cortner, H.J.; Carpenter, E.H.; Taylor, J.G. Public support for fire management policies in recreational land management. Final report of Eisenhower Consortium Project EC 294. Tempe, AZ: U.S. Department of Agriculture, Forest Service; 1983.



Wildland Fire Hazards: Safety and Survival Guidelines for Recreationists and Homeowners

Kathleen M. Davis and Robert W. Mutch

Respectively, resource management specialist, USDI National Park Service, Phoenix, AZ, and disaster program manager, USDA Forest Service, Washington, DC

The call of the wild hasn't diminished—more and more people are visiting the Nation's wildlands or building homes where wildlands and urban areas interface. Unfortunately, many of these people lack the knowledge needed for their personal safety. One threat is fire—not traditional campfires, although they can still be a problem, but free burning fires such as prescribed fires or wildfires. The chance of being hurt by a free burning fire is small; however, the risk of serious incidents is increasing as more people head to the wildlands for recreation or to find a tranquil place to live. The following guidelines were developed by fire professionals to provide caretakers of wilderness areas and the wildland/urban interface with the information that needs to be imparted to those not familiar with wildland fire and the threat that it poses.

The Threat of Fire

There are five possible ways in which people can be injured or killed by fire:

- Failure of the body's heat regulation mechanism
- Burning of the body by flames
- Searing of the lungs by superheated gases
- Inhalation of smoke and subsequent lack of oxygen
- Poisoning by carbon monoxide or other toxic gases

Fire Behavior

The science of fire behavior describes how fires burn in relation to the controlling factors of fuel, weather, and topography. No two fires are exactly alike, as there are almost infinite combinations of fuel, weather, and topographic situations. A cardinal rule of fire safety is to base all actions on current and expected behavior of a fire. Will the fire spread slowly or quickly? Will it remain on the ground or burn into the crowns of shrubs and trees? Or will wind currents carry burning embers beyond the main fire, causing the fire to burn hotter and faster, producing new fires in unexpected places?

Several early warning factors help signal the onset of "hotter" and "faster" burning conditions:

Fuel

- Flashy fuel (dead grass or long pine needles)
- More fuel
- Drier fuel
- Dead fuel
- Aerial fuel (combustible material suspended in the crowns of high shrubs and trees)

Weather

- Faster winds or sudden changes in speed and direction
- Unstable atmosphere (indicators: gusty winds, dust devils, and good visibility)
- Erratic and strong downdraft winds from towering cumulus clouds and dry thunderstorms
- Higher temperatures
- Drought conditions
- Lower humidities

Topography

- Steeper slopes
- South- and southwest-facing slopes
- Gaps or saddles
- Chimneys and narrow canyons

Fire Behavior

- Burning material rolling downhill and igniting fuel downslope
- Spot fires occurring ahead of main fire
- Individual trees "torching" out
- Shrubs or trees burning in a crown fire
- Smoldering fires over a large area
- Many fires starting simultaneously
- Fire whirls causing spot fires and erratic burning
- Intense burning with flame lengths greater than 4 feet
- Smoke column dark and massive with rolling, boiling vertical development
- Lateral movement of fire near base of steep slope

Extreme caution should be used when moving downhill toward a fire that can suddenly burn swiftly uphill. Also, care should be used when there is unburned fuel between you and fire, or when walking in dif-

Adapted from Kathleen M. Davis and Robert W. Mutch, Wildland fires: Dangers and survival. *In* Paul S. Auerbach and Edward C. Geehr, eds., Management of wilderness and environmental emergencies, New York, Toronto, and London: Macmillan; 1983: p. 451–480.

ficult terrain, darkness, or unfamiliar country.

The first step a person should take upon encountering a wildland fire is to review the principles and warning signals, size up the situation in terms of fuel, weather, topography, and observe fire behavior. After making an estimate of its probable direction and rate of spread, plan travel routes that avoid life hazards.

Travel and Evacuation Precautions

The following rules have been adapted from the "Ten Standard Orders" for firefighters to remind people of safety precautions while traveling near fires or evacuating from fire hazard areas:

1. Choose a leader at the outset who gives clear instructions and maintains control of the group.
2. Continually observe changes in speed and direction of fire and smoke to choose travel away from fire hazards.
3. Plan an alternate route in case fire suddenly changes direction and threatens you.
4. Keep aware of fire movement while traveling to avoid entrapment.
5. Be alert, keep calm, think clearly, and act decisively to avoid panic and to avoid injury from rolling or falling debris.

Escaping From Entrapment Situations

In some instances there may be no chance to avoid a fire. When entrapment is probable, injuries or death may be avoided by following these procedures:

1. *Do not panic.* If fear becomes overwhelming, judgment is seriously impaired and survival becomes a matter of chance.
2. *Do not run blindly or needlessly.* Unless the path of escape is clearly indicated, do not run. Move away from the flanks of the fire, traveling downhill where possible. Conserve your strength.
3. *Enter the burned area.* Do not delay. If escape means passing through the flame front into the burn area, do so when flames are less than 3 feet deep and you can see clearly through them. Cover exposed skin, take several breaths, and move through the flame front quickly.
4. *Burnout.* If you are unable to enter the burned area, ignite grass and other fine fuels between you and the fire edge. Step into this burned area and cover as much of your exposed skin as possible. This action will not be effective in heavier fuels that burn for a long time.
5. *Regulate breathing.* To avoid inhaling dense smoke, take shallow, slow breaths close to the ground.
6. *Protect against radiation.* Shield yourself from heat rays by seeking a shallow trench, crevice, large rock, lake, stream, large pond, vehicle, or building. Don't seek refuge in elevated water tanks. Wells and caves generally should be avoided because oxygen may be quickly used up in these restricted places. Cover exposed skin with clothing or dirt.
7. *Lie prone.* In an emergency, lie flat with head down on an area that will not burn. Your chance of survival is greater in this position than if overtaken by fire when standing upright or kneeling.

Builders and homeowners create a hazardous situation by not clearing fuel from around structures in wildland areas.

Survival in a Vehicle

If trapped in a vehicle by fire, the following steps will enhance survival:

- Do not drive through dense smoke.
- Park away from the heaviest vegetation.
- Turn headlights on and ignition off.
- Do not leave the vehicle.
- Roll up windows and close air vents.
- Get on the floor and cover yourself with blanket or coat, if possible.
- Stay in the vehicle until the main fire passes.

Although it is frightening to be trapped in a car by fire, it is almost certain doom to attempt escape by running from fire. Awareness of a few facts may prevent panic:

1. The engine may stall and not restart.
2. Convection currents may rock vehicle.
3. Smoke and sparks may enter the vehicle.
4. The temperature will increase inside the vehicle.
5. Metal gas tanks and containers rarely explode.

Survival in Buildings

Fire protection agencies encourage people to evacuate homes and buildings, rather than staying behind to fight the fire. When threatened by an approaching fire, however, people may find a safer refuge in buildings than in the open. Safe refuge in buildings depends on the construction materials and reduction of fuels around the structure. A building usually offers protection during the passing of fire, even if it ignites later, because it shields against radiant heat and smoke. Take the following precautions before fire approaches:

1. Remove combustible items from around the house.
2. Close doors, windows, and vents. Turn on a light in each room for visibility in dense smoke.
3. Place water in containers to fight fire. A wet mop can be used to extinguish sparks or embers inside the building.
4. Locate garden hoses so they will reach any place on the house.
5. Prepare to use portable gasoline-powered pumps to take water from a swimming pool or tank.
6. If you have a combustible roof, wet it down or turn on any roof sprinklers.
7. Back car into the garage and shut car doors and windows. Disconnect the automatic garage door opener (in case of power failure you could not remove the car). Close all garage doors.
8. Close house windows and doors to prevent sparks from blowing inside. Close all doors inside the house to prevent draft. Open the damper on your fireplace to help stabilize outside-inside pressure, but close the fireplace screen so sparks will not ignite the contents of room.
9. Turn off pilot lights.
10. Take down drapes and curtains. Close all venetian blinds or noncombustible window coverings to reduce the amount of heat radiating into your home.
11. Go inside the house as the fire front approaches.
12. After the fire passes, check inside and outside the house for fires. It may be necessary to exit a burning building after the passage of the main fire front. ■

A Versatile New Mini-Pump/Sprinkler Kit

Thomas French and Bill E. Williams

Respectively, warehouseman and supervisory forestry technician, Payette National Forest, McCall, ID

Bigger isn't necessarily better! During 1986, personnel on the Payette National Forest developed and tested a mini-pump/sprinkler kit, mainly for use on small, initial attack fires. The kit is small, lightweight, and highly portable (fig. 1). At a cost of $677, it is also relatively inexpensive when compared to a Mark III pump kit at $2,688. The kit consists of the following items:

Item	*Cost*
A. Shindaiwa 2-cycle, centrifugal mini-pump, 12.8 pounds, rated at 36.7 gallons per minute (will run for 4 hours on 1 gallon of fuel)	$259
B. 700 feet of synthetic garden hose	$277
C. Four nozzles, two wyes, two shutoffs, plastic dam, tool kit with adapters, and a 1-gallon DOT 17E fuel can	$17
D. 6 plastic rainbird type sprinklers with shutoffs, twelve 18-inch PVC standpipes with adapters, 18 tent stakes, and nylon cord	$73
E. Federal Supply System pack and frame	$51
Total cost	$677

The pump kit fits into a standard FSS firefighter's personal gear pack attached to a pack frame (fig. 2). The sprinklers and standpipes are in a bag attached to the pack frame and can be used as needed. The kit weighs approximately 50 pounds with a full gallon of gasoline and can be carried by one person. Compare this to a Mark III, which weighs over 200 pounds with the same amount of hose and no fuel. Two people can set up the sprinkler kit in 15 minutes. The sprinkler system will deliver a wet line approximately 250 feet long by 60 feet wide, in a straight line, circle, or whatever configuration you want. The sprinkler heads can be set to sprinkle any portion of a circle, so if you set up your sprinkler on the fire line, you could set it to sprinkle only the burned side for mop-up purposes, or full circle for a 50 to 60 foot wide wet line for suppression or prescribed burning.

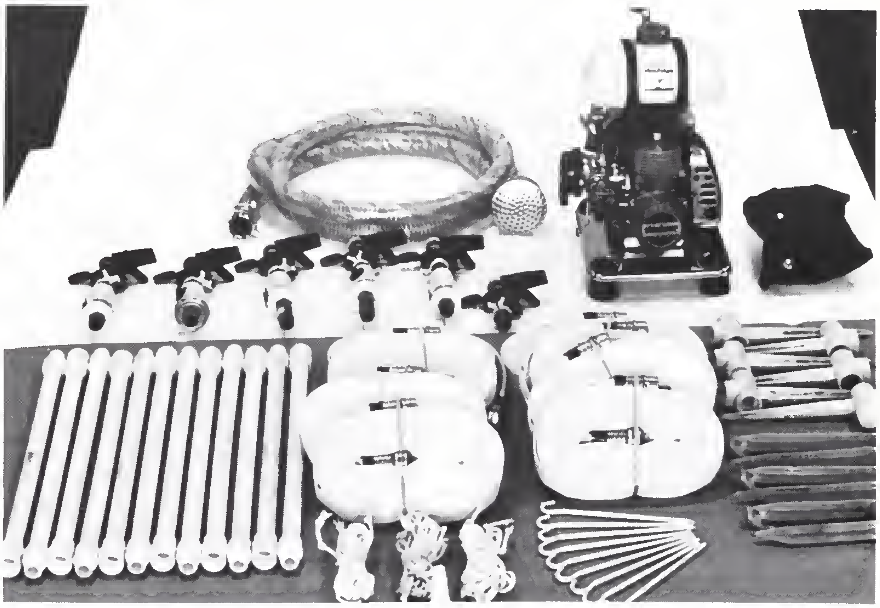


Figure 1—*Components of the mini-pump/sprinkler kit.*

The sprinkler heads all have shutoffs, so that each head can be regulated to get uniform pressure and coverage at each sprinkler. With five or six sprinkler heads, the pattern of water overlaps several feet from two sprinklers with 50 feet of hose between them.

To use the pump kit effectively, it is necessary to find a water source that is uphill from or close to the level of the use area. To use the pump kit in the conventional manner, the pump is set up at the water source, hose is attached, and wyes, shutoffs, and nozzles are added as needed. This system works well for control and mop-up of a small fire by two or three people. To use the sprinkler option, the base spikes are pushed into the ground, the standpipes are screwed into the bases, and the sprinkler heads screwed into the standpipes. The sprinkler heads can be set at ground level by screwing the head into the base spikes, or they can be raised 18 inches above ground by using one pipe or 36 inches above ground by using both pipes, to allow the sprinklers to clear the grass and brush that might restrict their operation.

Figure 2—*The kit fits in a standard FSS firefighter's personal gear pack attached to a pack frame.*

Next the tent stakes are pushed into the ground and the sprinkler heads tied to them with cord, stabilizing the unit (fig. 3). By connecting each sprinkler head to the next with 50 feet of hose, you are ready to sprinkle an area of approximately 15,000 square feet. The sprinkler option can be used on mop-up to wet part of the fire down while the crew eats or sleeps, or while they work on another part of the fire. The kit can be transported by either helicopter or paracargo and is especially suited to use in inaccessible backcountry areas.

After field testing, the following uses are felt to be practical for the mini-pump/sprinkler kit:

1. Control and mop-up of small wildfires, or for selected hot spots on larger fires.

2. Use sprinkler option and wet line to help contain or confine fires or parts of fires during modified suppression actions.

Figure 3—*The sprinkler element of the kit, ready to use.*

3. Use on wilderness or other fires to reduce or eliminate disruption of the site by fire lines.

4. Use sprinkler option and wet line to help protect structures or other improvements threatened by wildfires.

5. Use wet line option to help hold critical areas during prescribed burns, and to soak fuels around the perimeter prior to burns.

6. Use at helibases, helispots, and in camps to control dust. This is a major effort and expense on many large fires, which ties up expensive engines or water tenders that could be more effectively used on the fire line.

The mini-pump/sprinkler kit is not intended to replace or compete with the larger pump kits. If you need to lift water up a hill with high pressure and high volume, the Mark III or other standard kit is appropriate. The mini-pump/sprinkler kit is intended for those other circumstances when a light, portable, easy to use pump with sprinkler capability is needed, or when the sprinkler option is needed in conjunction with one of the larger pump kits.

After demonstrations and field testing during the 1986 fire season, the Payette National Forest is building eight kits for use in 1987 with smokejumpers, helitack, and ground crews. Recently, the Salmon National Forest has requested that two kits be built for them. We believe that many wildland fire agencies will find the mini-pump/sprinkler kit applicable to their situation also. For some uses, we feel that the advantages of the "mini are many." ■

Calibrating the Initial Attack Analysis Process

Alexander P. Dimitrakopoulos

Graduate student, Department of Forestry and Resource Management, University of California, Berkeley, CA

One aspect of National Fire Management Analysis System (NFMAS) is the evaluation of alternative fire management programs to achieve a cost-efficient allocation of presuppression and suppression resources. The Initial Attack Analysis (IAA) program of NFMAS evaluates integrated fuels, prevention, detection and initial attack options over the range of potential fire behavior conditions under which fires may occur on the planning unit (*1,2*). The program's outputs are the expected values of the numbers of fires and acres burned by firesize and intensity on an annual basis. On these values is based the subsequent calculation of economic cost and net value change (C+NVC).

The appropriate use of the IAA simulator requires knowledge of the program's sensitivity to changes regarding fire behavior and fire suppression inputs. It is important to know which input values most influence IAA results and of these values that are significant, there is a need to define the range of variation that can occur without changing the optimal solution. Furthermore, calibration procedures become easier when the fire manager is aware of the input parameters that most affect IAA's outputs. Indeed, fire managers are faced with a problem when their IAA analysis outcomes (e.g., expected acres burned) do not reflect the area's fire history. This results in an unrealistic calculation of presuppression and suppression expenditures. In such cases a calibration of the model is necessary by changing the input values. Thus, it is important to know which fire behavior and fire suppression parameters most influence IAA's outcomes.

Methods

In conducting a sensitivity analysis we systematically vary the values of the model's parameters over some range of interest to determine if and how the outputs change. If we are dealing with an optimizing model, like IAA, we must determine how sensitive the optimizing criterion is to changes in the value of an input parameter.

The sensitivity analysis was performed by using the 1982 IAA analysis of the Stanislaus National Forest as a data base. Stanislaus National Forest data were used, instead of developing a hypothetical set of data, to ensure that our analysis reflects a realistic situation.

The IAA input parameters that were tested were the rate of fire spread, the fire size at discovery, and the productivity rates and the attack time of the suppression forces. The optimizing criterion used was the least cost plus net value change (C+NVC). IAA uses C+NVC to achieve a cost-efficient allocation of presuppression and suppression resources in alternative fire management programs. C+NVC consists of three economic inputs; a fixed presuppression cost, a variable suppression cost, and the net value change of all resources involved. The fire management option that results in the least C+NVC is considered the optimal solution. The sensitvity analysis of IAA with the Stanislaus data set determined which fire behavior and fire suppression inputs influence C+NVC the most and the least.

The procedure followed in the sensitivity analysis sought to determine the level of variation that is acceptable for each fire behavior and fire suppression input value *without affecting the optimal solution.* Thus, we varied one input variable at a time (e.g., rate of spread, fire size at discovery, productivity rate or attack time of suppression forces), keeping all other parameters constant, until the increase of the C+NVC caused by this variation resulted in the selection of a different solution.

In our analysis four fire management zones representing approximately 95 percent of the total forest area were considered to be sufficient for the study's objectives. Five different budget level options (±20%, ±40% of the base level) were considered. The base level expenditures reflected the current resource allocation for fire management purposes at that time. The results of running IAA with the different budget levels are shown in table 1. The +20% of the base level option resulted in the least C+NVC and therefore was the

Table 1—*C+NVC for the IAA analysis of the Stanislaus National Forest heavy ground attack emphasis (optimal budget level is the BASE + 20%)*

Budget Level		+40%	+20%	BASE	-20%	-40%
	FMAZ 1	40,684	43,011	57,376	98,889	127,384
Suppression	FMAZ 2	2,785	2,721	2,721	5,313	7,005
cost + NVC	FMAZ 9	996,844	994,206	1,834,266	3,262,008	2,547,039
	FMAZ 13	3,247	3,694	3,694	22,359	23,017
Presuppression cost		2,330,923	1,998,536	1,665,535	1,329,043	938,311
Total C + NVC		3,374,483	3,042,168	3,563,592	4,717,612	3,642,756

optimal solution. The +40% of the base level option was the next most cost-efficient alternative.

The computer gaming process was applied in order to determine the percentage by which each fire behavior and fire suppression input parameter could vary from its optimal solution value, without a different alternative becoming optimal. I varied one parameter at a time, keeping all other parameters constant, until the increase of the C+NVC caused by this variation resulted to the optimization of a different solution. Thus, the input values of the optimal solution (+20% of the base level), were increased up to the point where the total C+NVC that resulted from this increase did not exceed the total C+NVC of the next most cost-efficient solution (+40% of the base level).

Table 2—*Results of the IAA's sensitivity analysis conducted with the Stanislaus National Forest data base*

IAA input parameter	Percentage of allowable variation of the optimal option input values without changing optimal solution
Size at discovery	+ 10,457
Attack time	+ 20
Productivity rates	- 18
Rate of spread	+ 9

Results and Discussion

The results of IAA's sensitivity analysis with the Stanislaus data base are shown in table 2. IAA results are most sensitive to changes in the rate of fire spread, followed by the productivity rates of the suppression forces, the suppression forces attack time and the fire size at discovery. Thus, 9-percent change of the input value used in the optimal solution for the rate of fire spread, 18-percent change of the productivity rates, 20-percent change of the suppression forces attack time, and 10,456-percent change of the fire size at discovery were necessary to affect the optimality of the solution. Although it must be remembered that these particular values refer only to the Stanislaus National Forest 1982 data base, they do nevertheless provide an indication of the program's general sensitivity to these fire behavior input parameters. However, data from another forest may generate different results.

One concern that arose from this analysis was IAA's apparent extreme insensitivity to fire size at discovery (a 10,456-percent change was necessary to change the optimality of the optimal solution). Therefore, the examination of fire detection alternatives may not be realistic with the current structure of the IAA program. ■

Literature Cited

1. U.S. Department of Agriculture, Forest Service. Fire management analysis and planning handbook. For. Serv. Handb. 5109–19. Washington, DC: U.S. Department of Agriculture, Forest Service; 1983. 100 p.
2. U.S. Department of Agriculture, Forest Service. National fire management analysis system user's guide. Washington, DC: U.S. Department of Agriculture, Forest Service; 1983. 70 p.

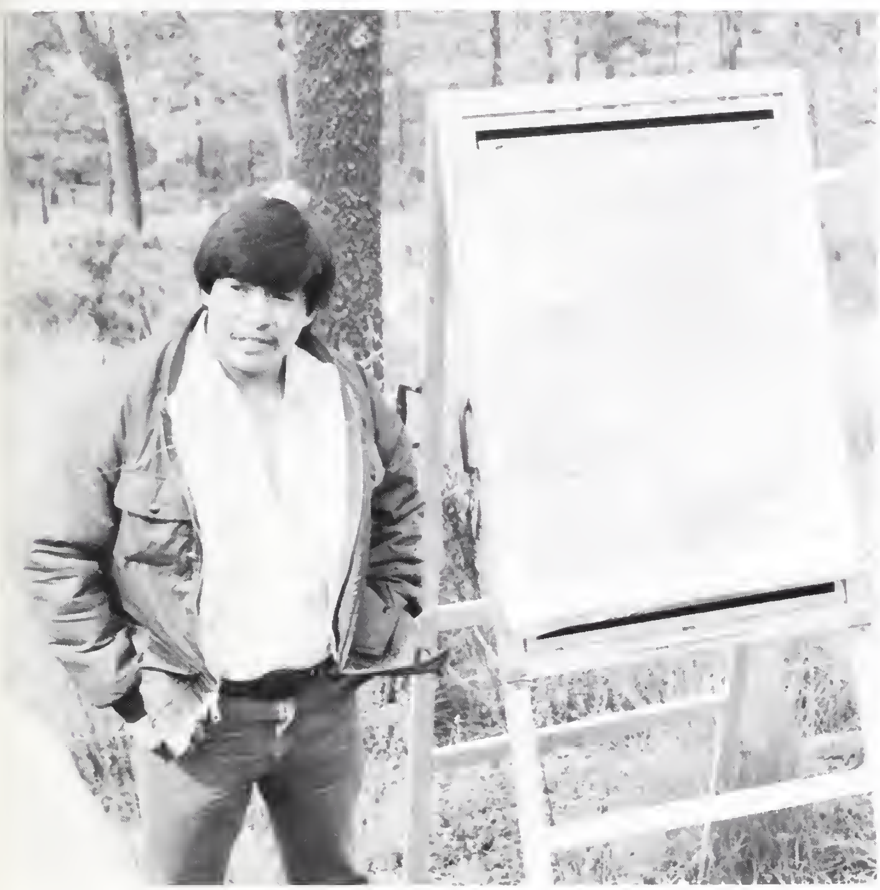
A Look at Fire Prevention in Mexico

James C. Sorenson

Group leader, USDA Forest Service, Southern Region, Atlanta, GA

A notion commonly held by firefighting personnel is that no one else has such serious fire problems as they do. No one else has as flammable fuels, as steep a terrain, or as unusual fire causes. Such misconceptions are best corrected when firefighters from one area visit their colleagues in another area. Personnel from the Southern Region of the USDA Forest Service and the Texas Forest Service had such an opportunity during a weeklong look at fire prevention activities being conducted by the Secretaria De Agricultura Y Recirsos Hidraulicos (SARH) in Mexico. It soon became apparent to the visitors that Mexican fire management officials experience many of the same problems as we do in the United States. It is in the solutions to the problems that differences begin to show.

In the realm of forest fire suppression, there is not much difference to be noted, except that there is much less use of heavy machinery on the Mexican side, at least in the area around Mexico City. Steep slopes and a lack of roads dictate reliance on 15-person fire brigades, which are strategically located in camps during fire season. Hand tools include traditional digging and grubbing implements that would be easily recognized by firefighters from the United States, in addition to other cutting tools more suited to dealing with the succulent cactus species that make up many of the fuel types. Some use is made of helicopter buckets and aerial tankers where appropriate, but government hand crews and local volunteers suppress most fires.



Mexican fire official describes the fire prevention program used in the Sierra Madre Mountains.

Traditional methods of fire prevention such as television or radio messages and posters have limited application in Mexico. Multimedia messages produced in Spanish reach a majority of the population; however, a significant number of the people living in fire-prone regions are Indians, and the number of different languages and dialects spoken in these regions precludes the reliance on mass-produced messages. A prevention campaign requires custom-made measures in many cases.

Government land managers have begun to use prescribed fire as a silvicultural tool, but it is in the role of fuels modifier that this tool, relatively new in Mexico, is showing immediate promise. Much of the destructive burning in the Mexican forests results from local residents burning off the tough, cured bunch grasses to bring on the new, green growth that is preferred by their sheep and cattle. This burning is often done without regard to the factors affecting fire behavior, and the result can be large, destructive wildfires. Local foresters have begun

developing training programs to help farmers to learn proper fire use. This represents a major departure from past methods of dealing with this source of wildfires.

Another major fire prevention effort involves changing attitudes about the multiple values of the forest. Most of the land in Mexico is owned by the Government, but local residents are able to make use of it under a permit system. This use is normally limited to an agricultural or pastoral activity, and the forest is often considered to be an impediment rather than a possible source of additional income.

Government forestry officials are working with influential members of communities to encourage people to plant and nurture trees for future utilization. This develops a sense of ownership of the forest, which leads to an increased awareness of the need for fire protection.

Hosts and visitors inspect helipad at fire brigade camp near Cuernavaca, Mexico.

Probably one of the most innovative steps being taken to deal with the fire problem is a trial introduction of a legume (*Vicia villosa*) that is interplanted with the corn crop to provide winter forage after the corn is harvested. The importance of this interplanting is that farmers no longer have to move their cattle into the forests for winter grazing. The need for winter grazing encouraged burning of the woods to extend the available grazing area and also contributed to trampling of seedlings and compaction of the soil. Besides taking the pressure off the woodlands pasture, the legume forage provides a lush, green fire break for a portion of the year.

The project is too new for final evaluation, and funds are limited for expansion into a much larger area at the present. However, the experiment will be carefully studied and may well offer yet another tool for fire prevention.

An unanticipated aspect of the trip to Mexico was the development of a close professional working relationship between members of the forest fire communities in Mexico and Texas. Discussions between the participants pointed out the many similarities in problems and highlighted areas of possible cooperation for mutual benefit in the future. ■


Por un simple descuido,
un cerillo puede terminar
con todo un bosque.

United States
Department of Agriculture

Washington, D.C.
20250

Superintendent of Documents Subscriptions Order Form

Order Processing Code
*

Charge your order. It's easy! MasterCard VISA CHOICE

☐ **YES,** please send me the following indicated subscriptions:

_____ subscription(s) to **FIRE MANAGEMENT NOTES** for $8.00 each per year domestic, $10.00 per year foreign

☐ **New** ☐ **Renewal**

1. The total cost of my order is $_____ . All prices include regular domestic postage and handling and are subject to change. International customers please add 25%.

Please Type or Print

2. ______________________________
(Company or personal name)

____
(Additional address/attention line)

____
(Street address)

____
(City, State, ZIP Code)

(   ) ______________________________
(Daytime phone including area code)

3. Please choose method of payment:

☐ Check payable to the Superintendent of Documents

☐ GPO Deposit Account ☐☐☐☐☐☐☐ – ☐

☐ VISA, CHOICE or MasterCard Account

☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

____
(Credit card expiration date)

Thank you for your order!

____
(Signature)

4. Mail To: Superintendent of Documents, Government Printing Office, Washington, D.C. 20402-9371